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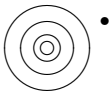
DISTANT EKOs



The Kuiper Belt Electronic Newsletter

Edited by: Joel Wm. Parker

ekonews@boulder.swri.edu www.boulder.swri.edu/ekonews

CONTENTS

NEWS & ANNOUNCEMENTS

There were 6 new TNO discoveries announced since the previous issue of *Distant EKOs*:

2010 RE64, 2010 RF43, 2010 RF64, 2010 RM45, 2010 RN45, 2010 RN64

and 5 new Centaur/SDO discoveries:

2010 BK118, 2010 RG43, 2010 RM64, 2010 RO64, 2010 TH

Reclassified objects:

2009 YE7 (SDO → TNO)
2010 PT66 (TNO → SDO)

Objects recently assigned numbers:

2002 KY14 = (250112)

Current number of TNOs: 1155 (including Pluto)
Current number of Centaurs/SDOs: 289
Current number of Neptune Trojans: 7

Out of a total of 1451 objects:

632 have measurements from only one opposition
581 of those have had no measurements for more than a year
324 of those have arcs shorter than 10 days

(for more details, see: `http://www.boulder.swri.edu/ekonews/objects/recov_stats.jpg`)

PAPERS ACCEPTED TO JOURNALS

"TNOs are Cool": A Survey of the trans-Neptunian Region III. Thermophysical Properties of 90482 Orcus and 136472 Makemake

T.L. Lim[1], J. Stansberry[2], T.G. Müller[3], M. Mueller[4], E. Lellouch[5], C. Kiss[6], P. Santos-Sanz[5], E. Vilenius[3], S. Protopapa[7], R. Moreno[5], A. Delsanti[5,8], R. Duffard[9], S. Fornasier[5,10], O. Groussin[8], A.W. Harris[11], F. Henry[5], J. Horner[12], P. Lacerda[13], M. Mommert[11], J.L. Ortiz[9], M. Rengel[7], A. Thirouin[9], D. Trilling[14], A. Barucci[5], J. Crovisier[5], A. Doressoundiram[5], E. Dotto[15], P.J. Gutiérrez Buenestado[9], O. Hainaut[16], P. Hartogh[7], D. Hestroffer[17], M. Kidger[18], L. Lara[9], B.M. Swinyard[1], and N. Thomas[19]

[1] Space Science and Technology Department, Rutherford Appleton Laboratory, Chilton, Didcot, Oxon UK, OX11 0QX

[2] The University of Arizona, Tucson AZ 85721, USA

[3] Max-Planck-Institut für extraterrestrische Physik, Giessenbachstrasse, 85748 Garching, Germany

[4] University de Nice Sophia Antipolis, CNRS, Observatoire de la Côte d'Azur, Laboratoire Cassiopée B.P. 4229, 06304 NICE Cedex 4, France

[5]Observatoire de Paris, Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA), 5 Place Jules Janssen, 92195 Meudon Cedex, France

[6] Konkoly Observatory of the Hungarian Academy of Sciences, H-1525 Budapest, P.O.Box 67, Hungary

[7] Max-Planck-Institut für Sonnensystemforschung, Max-Planck-Straße 2, 37191 Katlenburg-Lindau, Germany

[8] Laboratoire d'Astrophysique de Marseille, CNRS & Université de Provence, 38 rue Frédéric Joliot-Curie, 13388 Marseille cedex 13, France

[9] Instituto de Astrofísica de Andalucía (CSIC) C/ Camino Bajo de Huétor, 50, 18008 Granada, Spain

[10] Observatoire de Paris, Laoratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA), University of Paris 7 "Denis Diderot", 4 rue Elsa Morante, 75205 Paris Cedex, France

[11] Deutsches Zentrum für Luft- und Raumfahrt, Rutherfordstraße 2, 12489 Berlin-Adlershof, Germany

[12] Dept. of Physics and Astronomy, Science Laboratories, Univ. of Durham, South Road, Durham, DH1 3LE, UK

[13] Newton Fellow of the Royal Society, Astrophysics Research Centre, Physics Building, Queen's University, Belfast, County Antrim, BT7 1NN, UK

[14] Northern Arizona University, Department of Physics & Astronomy, PO Box 6010, Flagstaff, AZ 86011, USA

[15] INAF-Osservatorio Astronomico di Roma, Via di Frascati, 33, 00040 Monte Porzio Catone, Italy

[16] ESO, Karl-Schwarzschild-Str. 2, 85748 Garching bei Müchen, Germany

[17] IMCCE/Observatoire de Paris, CNRS, 77 Av. Denfert-Rochereau, 75014 Paris, France

[18] Herschel Science Centre, European Space Astronomy Centre (ESAC), Camino bajo del Castillo, s/n, Urbanizacion Villafranca del Castillo, Villanueva de la Cañada, 28692 Madrid, Spain

[19] Universität Bern, Hochschulstrasse 4, CH-3012 Bern, Switzerland

The goal of the *Herschel* Open Time programme *TNOs are Cool!* is to derive the physical and thermal properties for a large sample of Centaurs, and trans-Neptunian objects (TNOs), including resonant, classical, detached and scattered disk objects. Based on observations of two targets we tried (i) to optimise the SPIRE observing technique for faint (close to the background confusion noise), slowly moving targets; (ii) to test different thermal model techniques; (iii) to determine radiometric diameter and albedo values; (iv) to compare with *Spitzer* results whenever possible. We obtained SPIRE photometry on two targets and PACS photometry on one of the targets. We present results for the two targets, (90482) Orcus and (136472) Makemake, observed with SPIRE and for one of those targets, Makemake, observed with PACS. We adopt $p_V = 0.27$ and $D = 850$ km as our best estimate of the albedo and diameter of Orcus using single terrain models. With two-terrain models for Makemake, the bright terrain is fitted by, $0.78 < p_V < 0.90$, and the dark terrain

$0.02 < p_V < 0.12$, giving $1360 < D < 1480$ km. A single terrain model was derived for Orcus through the SPIRE photometry combined with MIPS data. The Makemake data from MIPS, PACS and SPIRE combined are not compatible with a single terrain model, but can be modelled with a two-terrain fit. These science demonstration observations have shown that the scanning technique, which allows us to judge the influence of background structures, has proved to be a good basis for this key programme.

Published in: Astronomy & Astrophysics, 315, 148L (2010 July)

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The Inclinations of Faint Trans-Neptunian Objects

D.E. Trilling[1], C.I. Fuentes[1,2], and M.J. Holman[2]

[1] Department of Physics and Astronomy, Northern Arizona University, PO Box 6010, Flagstaff, AZ 86011, USA

[2] Harvard-Smithsonian Center for Astrophysics, 60 Garden Street, Cambridge, MA 02138, USA

Bernstein et al. (2004) found that the population of faint (R>26) trans-Neptunian objects (TNOs) known at that time was dominated by "Classical" objects, which have low inclinations ($i < 5°$) and distances 40–45 AU. Since those observations, the number of faint TNOs whose orbits are sufficiently well known to be classified as "Classical" or "Excited" has grown from 7 to 39. We analyze the dynamical classifications of faint TNOs known today and find that this population is dominated by Excited objects. We discuss some implications of this result.

To appear in: The Astrophysical Journal Letters
For preprints, contact `david.trilling@nau.edu`
or on the web at `http://arxiv.org/abs/1009.5157`

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Kuiper Belt Structure as a Reflection of the Migration Process of A Planet

V.V. Emel'yanenko[1]

[1] Institute of Astronomy, Russian Academy of Sciences, Moscow, Russia

One of the main particular features of the structure of the Kuiper Belt is that it contains clusters of objects of small orbital eccentricity and inclination ("cold population"). In order to solve the problem of the origin of the objects, we considered the process of the gravitational interaction of a comparatively small-mass planet with a planetesimal disk. We found that one particular property of the process is that the planet changes its direction of migration. The interaction with the planet results in the transportation of a considerable portion of planetesimals from the inner zone out to the Kuiper Belt. After such a transition of the objects, the planet returns to the inner regions of the planetesimal disk. Numerical simulations show that the reversible migration of a planet of a mass similar to that of the Earth can explain the main properties of the Kuiper Belts cold population orbit distribution.

Published in: Solar System Research, 44, 281 (2010 August)

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The Hill Stability of Low Mass Binaries in Hierarchical Triple Systems

J. Li[1], Y.-N. Fu[2], and Y.-S. Sun[1]

[1]Department of Astronomy & Key Laboratory of Modern Astronomy and Astrophysics in Ministry of Education, Nanjing University, Nanjing 210093, China

[2]Purple Mountain Observatory, Chinese Academy of Sciences, 2 West Beijing Road, Nanjing 210008, China

The Hill stability of the low mass binary system in the presence of a massive third body moving on a wider inclined orbit is investigated analytically. It is found that, in the case of the third body being on a nearly circular orbit, the region of Hill stability expands as the binary/third body mass ratio increases and the inclination (i) decreases. This i-dependence decreases very quickly with increasing eccentricity (e_2) of the third body relative to the binary barycentre. In fact, if e_2 is not extremely small, the Hill stable region can be approximately expressed in a closed form by setting $i = 90°$, and it contracts with increasing e_2 as e_2^2 for sufficiently low mass binary. Our analytic results are then applied to the observed triple star systems and the Kuiper Belt Binaries.

Published in: Celestial Mechanics and Dynamical Astronomy, 107, 21 (2010 May)

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Destruction of Binary Minor Planets During Neptune Scattering

Alex H. Parker[1] and JJ Kavelaars[2]

[1] Department of Astronomy, University of Victoria, Canada

[2] Herzberg Institute of Astrophysics, National Research Council of Canada, Canada

The existence of extremely wide binaries in the low-inclination component of the Kuiper Belt provides a unique handle on the dynamical history of this population. Some popular frameworks of the formation of the Kuiper Belt suggest that planetesimals were moved there from lower semi-major axis orbits by scattering encounters with Neptune. We test the effects such events would have on binary systems, and find that wide binaries are efficiently destroyed by the kinds of scattering events required to create the Kuiper Belt with this mechanism. This indicates that a binary-bearing component of the cold Kuiper Belt was emplaced through a gentler mechanism or was formed *in situ*.

Published in: The Astrophysical Journal Letters, 722, L204 (2010 October 20)

For preprints, contact `alexhp@uvic.ca`

or on the web at `http://arxiv.org/abs/1009.3495`

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The Size Distribution of the Neptune Trojans and the Missing Intermediate Sized Planetesimals

Scott S. Sheppard[1] and Chadwick A. Trujillo[2]

[1] Carnegie Institution of Washington, 5241 Broad Branch Rd. NW, Washington, DC 20015, USA

[2] Gemini Observatory, 670 North A'ohoku Place, Hilo, Hi 96720, USA

We present an ultra-deep survey for Neptune Trojans using the Subaru 8.2-m and Magellan 6.5-m telescopes. The survey reached a 50% detection efficiency in the R-band at $m_R = 25.7$ magnitudes and covered 49 square degrees of sky. $m_R = 25.7$ mags corresponds to Neptune Trojans that are about 16 km in radius (assuming an albedo of 0.05). A paucity of smaller Neptune Trojans (radii < 45 km) compared to larger ones was found. The brightest Neptune Trojans appear to follow a steep power-law slope ($q = 5 \pm 1$) similar to the brightest objects in the other known stable reservoirs such as the Kuiper Belt, Jupiter Trojans and main belt asteroids. We find a roll-over for the Neptune Trojans that occurs around a radii of $r = 45 \pm 10$ km ($m_R = 23.5 \pm 0.3$), which is also very similar to the other stable reservoirs. All the observed stable regions in the the solar system show evidence for Missing Intermediate Sized Planetesimals (MISPs). This indicates a primordial and not collisional origin, which suggests planetesimal formation proceeded directly from small to large objects. The scarcity of intermediate and smaller sized Neptune Trojans may limit them as being a strong source for the short period comets.

To appear in: The Astrophysical Journal Letters

For preprints, contact `sheppard@dtm.ciw.edu`

or on the web at `http://arxiv.org/abs/1009.5990`

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Evolution of Jovian planets in a Self-gravitating Planetesimal Disk

J. Li[1], L.-Y. Zhou[1], and Y.-S. Sun[1]

[1] Department of Astronomy & Key Laboratory of Modern Astronomy and Astrophysics in Ministry of Education, Nanjing University, Nanjing 210093, PR China

Aims. We explore the orbital evolution of the four Jovian planets embedded in a self-gravitating planetesimal disk, and the simultaneous accretion of small bodies by proto-Uranus and proto-Neptune.

Methods. We adopt the code *NBODY4* running on the GRAPE-type special-purpose computer for numerically simulating the primordial evolution of the outer Solar system, where the total gravitational forces due to the Sun, the four Jovian planets and the massive planetesimals are all taken into account.

Results. (1) There is no significant accretion of proto-Uranus and proto-Neptune during their migration stage, only by the order of 0.1 Earth mass. (2) The self-gravitating disk can provide a new replenishment of planetesimals outside a few AU beyond Neptune into the scattering zone, resulting in larger radial displacement of Neptune than in the non-self-gravitating disk. (3) The present location of Neptune requires an original planetesimal disk outer edge at $\sim$35 AU. (4) The distribution of the surviving planetesimals is very similar to the observed Kuiper Belt.

To appear in: Astronomy & Astrophysics

For preprints, contact `ljian@nju.edu.cn`

PAPERS RECENTLY SUBMITTED TO JOURNALS

Estimating the Density of Intermediate Size KBOs from Considerations of Volatile Retention

Amit Levi[1] **and Morris Podolak**[1]

Department of Geophysics & Planetary Science, Raymond and Beverly Sackler Faculty of Exact Sciences, Tel Aviv University, Tel Aviv. 69978, Israel

Submitted to: Icarus

Preprints available on the web at `http://arxiv.org/abs/1008.1105`

OTHER PAPERS OF INTEREST

Dust in the Edgeworth-Kuiper Belt Zone

J. Klačka[1], **L. Kómar**[1], **P. Páastor**[1,2]

[1] Faculty of Mathematics, Physics and Informatics, Comenius University Mlynská dolina, 842 48 Bratislava, Slovak Republic

[2] Tekov Observatory, Sokolovská 21, 934 01, Levice, Slovak Republic

For preprints, contact `klacka@fmph.uniba.sk`
or on the web at `http://arxiv.org/abs/1009.5860`

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Direct Detection of Seasonal Changes on Triton with HST

J.M. Bauer[1], **B.J. Buratti**[1], **J-Y. Li** [2], **J.A. Mosher**[1], **M.D. Hicks**[1], **B.E. Schmidt**[3], **and J.D. Goguen**[1]

[1] Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, MS 183-401, Pasadena, CA 91109, USA

[2] University of Maryland, Department of Astronomy, College Park, MD 20742, USA

[3] University of California, Los Angeles, Institute of Geophysics & Planetary Physics, 2240 1/2 S Carmelina Ave., Los Angeles, CA 90064, USA

To appear in: The Astrophysical Journal Letters, 723, L49 (2010 November 1)

The *Distant EKOs* Newsletter is dedicated to provide researchers with easy and rapid access to current work regarding the Kuiper belt (observational and theoretical studies), directly related objects (e.g., Pluto, Centaurs), and other areas of study when explicitly applied to the Kuiper belt.

We accept submissions for the following sections:
⋆ Abstracts of accepted papers
⋆ Titles of submitted (but not yet accepted) papers and conference articles
⋆ Thesis abstracts
⋆ Short articles, announcements, or editorials
⋆ Status reports of on-going programs
⋆ Requests for collaboration or observing coordination
⋆ Table of contents/outlines of books
⋆ Announcements for conferences
⋆ Job advertisements
⋆ General news items deemed of interest to the Kuiper belt community

A LaTeX template for submissions is appended to each issue of the newsletter, and is sent out regularly to the e-mail distribution list. Please use that template, and send your submission to:

`ekonews@boulder.swri.edu`

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`ekonews@boulder.swri.edu`